Valorization of organic wastes through anaerobic digestion processes

J.V. Oliveira; J.C. Costa; A. Abreu; M.A. Pereira; M.M. Alves

CEB - Centre of Biological Engineering, Universidade do Minho, 4710-057 Braga, Portugal
Group: BRIDGE | Line: Environmental Biotechnology and Bioengineering

Increasing demand for sustainable development has stimulated political interest in measures to decrease pollution and greenhouse gas production by human activities. The greatest technological challenge for human society today is the replacement of fossil fuels by energy sources that are renewable and carbon neutral. One way to meet this challenge is trough biological processes, which has the potential to generate large flows of renewable energy, useful for decentralized systems. Wastewaters, sludges, residues, and other 'wastes of today' must be viewed as resources, within the concept of "waste-to-energy".

Anaerobic digestion (AD) is one of the answers to sustainable development since it reduces carbon emissions, provides clean fertilizers, and generates a green energy carrier (biogas), while concomitantly waste(water) treatment is performed. AD strategies have been implementing in order to maximize the energetic and economic value of recalcitrant wastes.

Harvesting residues, like shrub, could result in an average potential energy supply of 4.6 $EJ \cdot yr^{-1}$, only in Europe. Macroalgae, which do not compete with food crops for arable land and irrigation water, has shown promising results in terms of methane production. The co-digestion of *Gracilaria vericulophylla* (481 $L \cdot kg^{-1}$ (volatile solids – VS)) with sewage sludge and glycerol increased the methane production in 26 %. *Sargassum* sp. produced 91 L of hydrogen and 541 L of methane per kg (VS), yielding a theoretical potential energy supply of 600 EJ yr^{-1}, from the potential ocean area available for macroalgae production. Moreover, food-processing industrial waste(water) showed potential for methane production, i.e. AD of brewery waste can result in an energy production of 360 $PJ \cdot yr^{-1}$ worldwide. AD is thus a promising environmentally feasible alternative to create renewable energy.